3713

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

CHOSACK et al

Serial No.: 09/600,952

Filed: July 25, 2000

For: Endoscopic Tutorial System

Examiner: Cameron Saadat

Group Art Unit: 3713

Attorney
Docket: 24688
(Previously S02/11)

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

RESPONSE TRANSMITTAL

Sir:

(1) Applicant is a:
_X_ small entity ___ verified statement attached
_X_ verified statement filed
___ other than small entity

(2) The fee for claims 37 CFR1.16(b)-(d) has been calculated as shown below:

	CLAIMS	AMENDED	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
FOR:	ON FILE	CLAIMS	RATE	FEE	OR	RATE	FEE
TOTAL CLAIMS	45	56	11 x 9=	$ 99	OR	x 18=	$
INDEP CLAIMS	5	7	2 x 43=	$ 86	OR	x 86=	$
			TOTAL	$ 185	OR	TOTAL	$

(3) An amendment _X_ is filed herewith
____ has been filed

(4) Please charge the claim surcharge fee and any other amount required to Deposit Account No. **50-1407**.
A duplicate copy of this form is enclosed.

Respectfully submitted,

D'vorah Graeser
Agent for Applicant
Registration No. 40,000

Date: December 15, 2003

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Serial No.: 09/600,952

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Examiner: C. SAADAT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

RESPONSE

Sir:

In response to the United States Patent and Trademark Office Action mailed July 17, 2003, which is being submitted on or before December 17 2003, and for which two months' late fees are due and are enclosed herewith, please make the following changes:

01/16/2004 ENIAMONS 00000006 531407 09600952

01 FC:2201 129.00 DA

02 FC:2202 63.00 DA

1. (Previously Amended) A system for performing a simulated medical procedure, comprising:

(a) a simulated organ;

(b) a simulated instrument for performing the simulated medical procedure on said simulated organ;

(c) a locator for determining a location of said simulated instrument within said simulated organ; and

(d) a visual display for displaying images according to said location of said simulated instrument within said simulated organ for providing visual feedback, such that said images simulate actual visual data received during an actual medical procedure as performed on an actual subject, said visual display including:

(i) a three-dimensional mathematical model for modeling said simulated organ according to a corresponding actual organ, said model being divided into a plurality of segments, said plurality of segments being arranged in a linear sequence;

(ii) a loader for selecting at least one of said plurality of segments from said linear sequence for display, said at least one of said plurality of segments being selected according to said location of said simulated instrument within said simulated organ;

(iii) a controller for selecting a simulated image from said segment according to said location of said simulated instrument; and

(iv) a displayer for displaying said simulated image.

2. (Original) The system of claim 1, wherein said visual displayer further comprises:

(v) a texture mapping database for storing texture mapping data; and

(vi) a texture mapping engine for overlaying said simulated image with said texture mapping data substantially before said simulated image is displayed by said displayer.

3. (Previously Amended) The system of claim 2, wherein said texture mapping data comprises animation of random movement of said simulated instrument and random movement of said simulated organ.

4. (Previously Amended) The system of claim 2, wherein said texture mapping data includes images obtained from performing said actual medical procedure on said actual subject.

5. (Original) The system of claim 4, wherein said images are obtained by first recording said visual data during said performance and then selecting said images from said recorded visual data.

6. (Original) The system of claim 1, wherein said mathematical model features a plurality of polygons constructed according to a spline, said spline determining a geometry of said mathematical model in three dimensions.

7. (Original) The system of claim 6, wherein a deformation in said mathematical model corresponding to a deformation in said simulated organ is determined by altering said spline.

8. (Original) The system of claim 7, wherein said deformation in said simulated organ is a local deformation, said local deformation of said simulated organ being determined according to said mathematical model by adding polygons to a portion of said mathematical model, such that said portion of said mathematical model is deformed to produce said local deformation.

9. (Original) The system of claim 6, wherein said mathematical model is constructed from said spline by modeling said simulated organ as a straight line and altering said spline until said mathematical model fits said corresponding actual organ.

10. (Original) The system of claim 9, wherein said controller selects said simulated image according to at least one previous movement of said simulated instrument within said simulated organ.

11. (Original) The system of claim 1, wherein said displayer further displays a graphical user interface.

12. (Original) The system of claim 11, wherein said graphical user interface displays tutorial information for aid in performing the medical procedure.

13. (Original) The system of claim 1, wherein said simulated organ is a gastro-intestinal tract.

14. (Original) The system of claim 13, wherein said gastro-intestinal tract is constructed from a semi-flexible, smooth material.

15. (Original) The system of claim 13, wherein said simulated instrument is an endoscope, said endoscope featuring a sensor for determining a location of said sensor in said gastro-intestinal tract, the system further comprising:

(e) a computer for determining said visual feedback according to said location of said sensor.

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16. (Original) The system of claim 15, further comprising a tactile feedback mechanism for providing simulated tactile feedback according to said location of said tip of said endoscope.

17. (Original) The system of claim 16, wherein said tactile feedback mechanism is contained in said gastro-intestinal tract, and said gastro-intestinal tract further comprises:

(i) a plurality of servo-motors;

(ii) a piston operated by each of said plurality of servo-motors, said piston contacting said semi-flexible material; and

(iii) a controller for controlling said plurality of servo-motors, such that a position of said piston is determined by said controller, and such that said position of said piston provides said tactile feedback.

18. (Previously Amended) A system for performing a simulated medical procedure, comprising:

(a) a simulated organ, wherein said simulated organ is a gastro-intestinal tract;

(b) a simulated instrument for performing the simulated medical procedure on said simulated organ, wherein said simulated instrument is an endoscope, said endoscope featuring a sensor for determining a location of said sensor in said gastro-intestinal tract;

(c) a locator for determining a location of said simulated instrument within said simulated organ;

(d) a visual display for displaying images according to said location of said simulated instrument within said simulated organ for providing visual feedback, such that said images simulate actual visual data received during an actual medical procedure as performed on an actual subject, said visual display including:

(i) a three-dimensional mathematical model for modeling said simulated organ according to a corresponding actual organ, said model being divided into a plurality of segments, said plurality of segments being arranged in a linear sequence;

(ii) a loader for selecting at least one of said plurality of segments from said linear sequence for display, said at least one of said plurality of segments being selected according to said location of said simulated instrument within said simulated organ;

(iii) a controller for selecting a simulated image from said segment according to said location of said simulated instrument; and

(iv) a displayer for displaying said simulated image;

(e) a computer for determining said visual feedback according to said location of said sensor; and

(f) a tactile feedback mechanism for providing simulated tactile feedback according to said location of said tip of said endoscope, wherein said tactile feedback mechanism is located in said endoscope, and said endoscope further comprises:

(i) a guiding sleeve connected to said tip of said endoscope;

(ii) at least one ball bearing attached to said guiding sleeve for rolling along an inner surface of said gastro-intestinal tract;

(iii) at least one linear motor attached to said guiding sleeve;

(iv) a piston operated by said linear motor, said piston contacting said inner surface of said gastro-intestinal tract; and

(v) a controller for controlling said linear motor, such that a position of said piston is determined by said controller, and such that said position of said piston provides said tactile feedback.

19. (Original) The system of claim 16, wherein said tactile feedback mechanism features:

(i) a plurality of rings surrounding said endoscope, each ring having a different radius, at least a first ring featuring a radius greater than a radius of said endoscope and at least a second ring featuring a radius less than said radius of said endoscope, said radius of each of said plurality of rings being controlled according to a degree of inflation with air of each of said plurality of rings, said radius of said rings determining movement of said endoscope;

(ii) an air pump for pumping air into said plurality of rings;

(iii) at least one tube for connecting said air pump to said plurality of rings; and

(iv) an air pump controller for determining said degree of inflation with air of said plurality of rings by controlling said air pump.

20. (Original) The system of claim 19, wherein said at least one tube is two tubes, a first tube for pumping air into said plurality of rings and a second tube for suctioning air from said plurality of rings, and said air pump pumps air into said plurality of rings and sucks air from said plurality of rings, such that said degree of inflation with air of said plurality of rings is determined by alternately pumping air into, and suctioning air from, said plurality of rings.

21. (Original) The system of claim 16, wherein said gastro-intestinal tract is a substantially straight tube, such that said tactile feedback and said visual feedback are substantially independent of a geometrical shape of said gastro-intestinal tract.

22. (Original) The system of claim 16, wherein said tactile feedback mechanism is operated according to tactile feedback obtained during said performance of the medical procedure on an actual subject, said tactile feedback being obtained through virtual reality gloves.

23. (Original) The system of claim 15, wherein said endoscope further features a handle for holding said endoscope and a tool unit, said tool unit comprising:

(i) a simulated forceps;

(ii) a channel for receiving said simulated forceps, said channel being located in said handle;

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(iii) a tool control unit for detecting a movement of said simulated forceps, said tool control unit being located in said channel and said tool control unit being in communication with said computer, such that said computer determines said visual feedback and said tactile feedback according to said movement of said simulated forceps.

24. (Original) The system of claim 23, wherein said tool control unit detects a location of said simulated forceps within said gastro-intestinal tract for providing visual feedback.

25. (Original) The system of claim 24, wherein said tool control unit additionally detects a roll of said simulated forceps for providing visual feedback.

26. (Original) The system of claim 25, wherein said visual feedback includes a display of a simulated loop of said simulated forceps for performing a polypectomy.

27. (Previously Amended) A system for performing a simulated medical procedure, comprising:

(a) a simulated organ, wherein said simulated organ is a gastro-intestinal tract;

(b) a simulated instrument for performing the simulated medical procedure on said simulated organ, wherein said simulated instrument is an endoscope, said endoscope featuring a sensor for determining a location of said sensor in said gastro-intestinal tract;

(c) a locator for determining a location of said simulated instrument within said simulated organ;

(d) a visual display for displaying images according to said location of said simulated instrument within said simulated organ for providing visual feedback, such that said images simulate actual visual data received during an actual medical procedure as performed on an actual subject, said visual display including:

(i) a three-dimensional mathematical model for modeling said simulated organ according to a corresponding actual organ, said model being divided into a plurality of segments, said plurality of segments being arranged in a linear sequence;

(ii) a loader for selecting at least one of said plurality of segments from said linear sequence for display, said at least one of said plurality of segments being selected according to said location of said simulated instrument within said simulated organ;

(iii) a controller for selecting a simulated image from said segment according to said location of said simulated instrument; and

(iv) a displayer for displaying said simulated image; and

(e) a computer for determining said visual feedback according to said location of said sensor,

wherein said endoscope further features a handle for holding said endoscope and a tool unit, said tool unit comprising:

(i) a simulated forceps;

(ii) a channel for receiving said simulated forceps, said channel being located in said handle; and

(iii) a tool control unit for detecting a movement of said simulated forceps, said tool control unit being located in said channel and said tool control unit being in communication with said computer, such that said computer determines said visual feedback and said tactile feedback according to said movement of said simulated forceps.

claims 28-38: (Canceled)

39. (Previously Added) The system of claim 1, wherein said loader further comprises a rapidly accessed memory for storing said segment.

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40. (Previously Added) The system of claim 1, wherein said mathematical model features a plurality of polygons defined with respect to a spline, said spline determining a geometry of said mathematical model in three dimensions.

41. (Previously Added) The system of claim 40, wherein said simulated instrument is an endoscope featuring an endoscope cable, said endoscope cable forming a loop from a movement of said endoscope in said simulated organ, said loop being modeled according to a mathematical model.

42. (Previously Added) The system of claim 41, wherein said mathematical model for said loop features a plurality of polygons defined with respect to a spline.

43. (Previously Added) The system of claim 42, wherein a size of said loop is determined according to a differential between an amount of said endoscope cable within said simulated organ and a length of said simulated organ from an entry point of said endoscope to a current position of said endoscope within said simulated organ.

44. (Previously Added) A system for performing a simulated medical procedure, comprising:

(a) a simulated organ;

(b) a simulated instrument for performing the simulated medical procedure on said simulated organ;

(c) a locator for determining a location of said simulated instrument within said simulated organ; and

(d) a visual display for displaying images according to said location of said simulated instrument within said simulated organ for providing visual feedback, such that said images simulate actual visual data received during an actual medical procedure as performed on an actual subject, said visual display including:

(i) a three-dimensional mathematical model for modeling said simulated organ according to a corresponding actual organ, said model being divided into a plurality of segments, said plurality of segments being arranged in a linear sequence;

(ii) a loader for selecting at least one of said plurality of segments from said linear sequence for display, said at least one of said plurality of segments being selected according to said location of said simulated instrument within said simulated organ;

(iii) a controller for selecting a simulated image from said segment according to said location of said simulated instrument;

(iv) a displayer for displaying said simulated image;

(v) a texture mapping database for storing texture mapping data, said texture mapping data comprising at least one of animation of random movement of said simulated instrument and random movement of said simulated organ; and

(vi) a texture mapping engine for overlaying said simulated image with said texture mapping data substantially before said simulated image is displayed by said displayer.

45. (Previously Added) A system for performing a simulated medical procedure, comprising:

(a) a simulated organ;

(b) a simulated instrument for performing the simulated medical procedure on said simulated organ;

(c) a locator for determining a location of said simulated instrument within said simulated organ; and

(d) a visual display for displaying images according to said location of said simulated instrument within said simulated organ for providing visual feedback, such that said images simulate actual visual data received during an actual medical procedure as performed on an actual subject, said visual display including:

(i) a three-dimensional mathematical model for modeling said simulated organ according to a corresponding actual organ, said model being divided into a plurality of segments, said plurality of segments being arranged in a linear sequence, wherein said mathematical model features a plurality of polygons defined with respect to a spline, said spline determining a geometry of said mathematical model in three dimensions;

(ii) a loader for selecting at least one of said plurality of segments from said linear sequence for display, said at least one of said plurality of segments being selected according to said location of said simulated instrument within said simulated organ;

(iii) a controller for selecting a simulated image from said segment according to said location of said simulated instrument; and

(iv) a displayer for displaying said simulated image.

Please add new claims 46-56:

46. (New) A system for simulating a medical procedure, the system comprising:

(a) an instrument for being manipulated for performing the simulated medical procedure;

(b) a three-dimensional mathematical model of an organ, such that a virtual location of said instrument in the organ during the simulated medical procedure is determined according to said three-dimensional mathematical model,

wherein said mathematical model features a spline, said spline determining a geometry of said mathematical model in three dimensions;

(c) a visual display for providing visual feedback according to said virtual location and said three-dimensional mathematical model; and

(d) a tactile feedback mechanism for providing simulated tactile feedback according to said virtual location of said instrument.

47. (New) The system of claim 46, wherein a deformation in said mathematical model corresponding to a deformation in the organ is determined by altering said spline.

48. (New) The system of claim 47, wherein said deformation in the organ is a local deformation, said local deformation of said simulated organ being determined according to said mathematical model by adding polygons to a portion of said mathematical model, such that said portion of said mathematical model is deformed to produce said local deformation.

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49. (New) The system of claim 46, wherein said mathematical model is constructed from said spline by modeling the organ as a straight line and altering said spline until said mathematical model fits the organ.

50. (New) The system of claim 46, wherein said instrument comprises a forceps and said visual feedback includes a display of a simulated loop of said forceps for performing a polypectomy.

51. (New) The system of claim 46, wherein said instrument is an endoscope featuring an endoscope cable, said endoscope cable forming a loop from a movement of said endoscope in the organ, said loop being modeled according to a mathematical model.

52. (New) The system of claim 51, wherein said mathematical model for said loop features a plurality of polygons defined with respect to a spline.

53. (New) The system of claim 52, wherein a size of said loop is determined according to a differential between an amount of said endoscope cable within the organ and a length of the organ from an entry point of said endoscope to said virtual location of said endoscope within the organ.

54. (New) A system for simulating a medical surgical procedure comprising a three-dimensional mathematical model corresponding to an actual organ, wherein said mathematical model is comprised of a plurality of polygons constructed according to a mathematical spline-based algorithm, said spline determining a geometry of said mathematical model in three dimensions that is capable of providing visual and tactile feedback.

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55. (New) The system of claim 54, whereby the spline-based algorithms are capable of operating on a standard PC computer processor.

56. (New) The system of claim 54, whereby the spline-based algorithms are recalculated to provide real-time visual and haptic feedback.